

POLICY ON THE MANAGEMENT OF LOW LEVEL RADIOACTIVE WASTES

IN TAIWAN, R.O.C.

C.S. Yeh, C.M. Tsai
Radwaste Administration, Atomic Energy Council R.O.C.
Taipei, Taiwan, R.O.C.

ABSTRACT

The nuclear energy development in Taiwan, R.O.C. has been over twenty years. Now, there will be more than 13,000 drums of low level radioactive waste generated from the six nuclear power units and two research reactors each year. The management of them in this small but densely populated island seems to be difficult. To minimize the environmental impact from the low level radioactive waste, a long term program to shape up the management policy has been launched by the Radwaste Administration since 1981, when it was instituted. This paper describes the four general principles concluded from its preliminary study.

INTRODUCTION

Since 1961, when an education reactor was installed in the National Tsing Hua University, the nuclear energy has been developed in Taiwan, R.O.C. for over twenty years. Up to now, there are six nuclear power units with the total output of 5140 MWe and two research reactors are in operation.

As Taiwan is a densely populated island, the inevitable generated radioactive waste from the reactors should be carefully managed as to minimize the impact to the environment.

In order to achieve safe management of the radioactive waste and to protect the public health, the Atomic Energy Council decided to install a storage site in Lan-Yu, an eastern small island, 75 km from Taiwan proper, to temporarily store the low level radioactive waste before the final disposal, and to institute an organization to manage the radioactive waste.

In 1981, the Radwaste Administration (RWA) was instituted. In 1982, the Lan-Yu Storage Site was completed and started to accept the radwaste. Up to now, 35,000 drums of radwaste have been shipped to Lan-Yu and well stored in the site.

GENERAL PRINCIPLES OF THE WASTE MANAGEMENT POLICY

From the year of its institution, RWA has conducted a long term program to shape up the management policy. Although the policy is not yet well defined, some preliminary conclusions as followings are proposed as the basis of the low level waste management policy.

1. The handling, collection, packaging, transportation and on-site storage of LLW are the responsibilities of producers.

The radioactive waste from nuclear power reactors must be dealt with in accordance with the regulations of RWA and then be processed on site. The waste from research centers, universities, hospitals and laboratories may be processed by the service provided by the waste treatment center of Institute of Nuclear Energy Research (INER), AEC..

The design of these systems should be approved by RWA. To review them, experts from universities,

institutes and other related government authorities are invited to join RWA staffs.

As for the transportation of LLW, a radwaste producer should submit transportation plan and Emergency Response plan to Radwaste Administration for approval. When this plan is accepted, in accordance with it a shipment request form should be submitted for approval each time.

Before the transportation, the LLW is required to store on-site for 2 to 3 years for further decay. Also the design of on-site storage facilities are required to be approved by RWA.

During the operations of handling, collection, packaging, transportation and on-site storage, RWA will send inspectors to verify that all these activities are performed in accordance with the regulations.

To ensure the safety, RWA has developed and published already eight different regulations, guidelines. Further developments are still carried on. The inspection techniques and instruments are also modified or developed.

2. Volume reduction of LLW is considered as the most important task in the near future.

Based on the design of the existing systems, more than 13,000 drums will be generated each year. If no effective measures are taken to reduce the volume, the Lan-Yu Storage Site with the capacity of 330,000 drums will be fully loaded in 25 years or sooner if new nuclear facilities are added during this period and final disposal is not yet performed. After reviewing the existing management system in utilities, RWA staffs proposed the following volume reduction principles.

- (i) The personnel in handling the radwaste should be professional. All the workers should be trained before starting their jobs.
- (ii) The existing treatment systems in nuclear power plants should be backfitted to reduce their waste generation rate as low as possible.
- (iii) Utilities should improve their management system to limit the generation of secondary or unnecessary waste.
- (iv) RWA cooperates with the utilities to

evaluate all the feasible facilities or methods to decrease the volume of waste generated.

- (v) RWA implements the regulations to limit the volume of LLW generated by utilities. Allocation of the volume accepted by the Lan-Yu Storage Site for the utilities will be designed to enforce the utilities to reduce their generated waste volume.

On half of the existing generation rate is considered the reasonable target for utilities to achieve in the future. RWA will also cooperate with the utilities to develop the volume reduction technologies to further decrease the waste volume.

3. The alternative of final disposal will be decided by RWA before 1995. Before that, all the packages prepared by utilities should meet the requirements of both sea dumping and land burial.

In 1970s, sea dumping was considered the most feasible final disposal alternative in this country. The requirements of the candidate sites were also set as follows:

- The off-shore distance of the target areas should be within 200 nautical miles.
- The vertical circulation cycle above the target areas should be longer than 800 years.
- Bottom surface of the target areas should be covered with soft and fine grained sediments, and the rate of sedimentation should be fairly high.
- The sea floors of the target areas should be relatively stable, and should be free from active fault and turbidity current.
- The density of bottom should be less than the bulk density of the waste (1.4g/cm^3)
- The depth of the sea floor should be greater than 5,000 meters.
- No strong currents flow above the target areas so that the placement of the waste barrel can be controlled.
- The sites should be free from under sea cables and also lie outside the sailing routes.
- There should be no evidence to indicate the presence of exploitable direct or indirect resources on the seabed of the dumping sites. Also so far is known, the sites must not be spawning or nursery areas.

Up to now, three candidate sites that meet the requirements set above have been found. Further oceanographical surveys at the candidate sites and various preparatory works, such as design of dumping ship development and demonstration of unloading gear for dumping of the packages, confirmation of accuracy of navigation aids, quality control of the packages and so on, are under studies.

Realizing the sea dumping is not simple a technical issue, RWA is also developing the land burial as a backup system if sea dumping is not accepted by domestic people and neighbor countries for some other factors. The surveys of the candidate sites performed during the selection of storage site were reviewed by RWA staffs and it was proposed that improved shallow land burial in Lan-Yu is the most likely method.

The basic requirements of the design of improved shallow land burial are also set as follows:

- Social Acceptance

- The radiological impact to an average person of critical population should not exceed 5 mrem per year.
- The buried solid or solidified radioactive waste should be retrievable in convenient conditions.
- Should be ready for final disposal without the need for any reconstruction process.
- Environmental aesthetics.
- Institutional control 100 years.

At the end of 1985, 12 foreign consulting companies were invited to bid for the basic design of a pilot plan with a capacity of 100,000 drums. In this coming June, the basic design will be finished. After that the detail design will be followed by a domestic consulting company. It is expected the facility will be completed by 1988.

With the aim of establishing a matured disposal technologies, research and development are underway for these two alternatives. All the concerning factors will be evaluated for these two alternatives and the final decision is expected before 1995. Once the decision of final disposal is stated, the waste form criteria will be published by RWA. Before that, the waste form prepared should meet the requirements of both sea dumping and land burial. The criteria of that will be developed by RWA in the near future.

4. Public acceptance should be considered in the design of waste storage and disposal facilities.

As the matter of fact, helping people to understand is the best way to gain their cooperation. RWA decided to propaganda education program through media and other feasible channels.

Since 1982, RWA has produced up to 14 different brochures and 2 different kinds of slide show to introduce the waste management activities for the visitors. By the end of 1985, more than 5,000 people had been invited to visit the Lan-Yu Storage Site. Also RWA joins actively in Lan-Yu public affairs with the aim of getting acceptance from the inhabitants. The landscape of storage site is also redesigned as to make the site a new tourist spot in Lan-Yu to attract the visitors.

Having realized public acceptance will be a major factors in RWA's reviewing process of a new storage and disposal facility, the Taiwan Power Company is carrying on his education propaganda very actively. The back end management will be an important exhibition program in his two nuclear visitor centers which are scheduled to be opened in the near future.

SUMMARY

The implementation of waste management policy based on the four principles is going to be conducted by RWA. More and more universities and institutes will be invited to cooperate with RWA to perform research and development. The foreign experiences and technologies will also be evaluated and transferred if could be of help.

During the implementation process, different task forces are organized. Up to now, two task forces namely waste form criteria implementation technical team and waste package improvement study team have been formed. Other task forces, such as final disposal study team, environment impact study team, ..., etc., will also be organized. Although the whole process

of implementation will take a long time, RWA hopes the policy thus made to be a much safer one.

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REFERENCES

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